AT MICROFICHE REFERENCE LIBRARY
A project of Volunteers in Asia

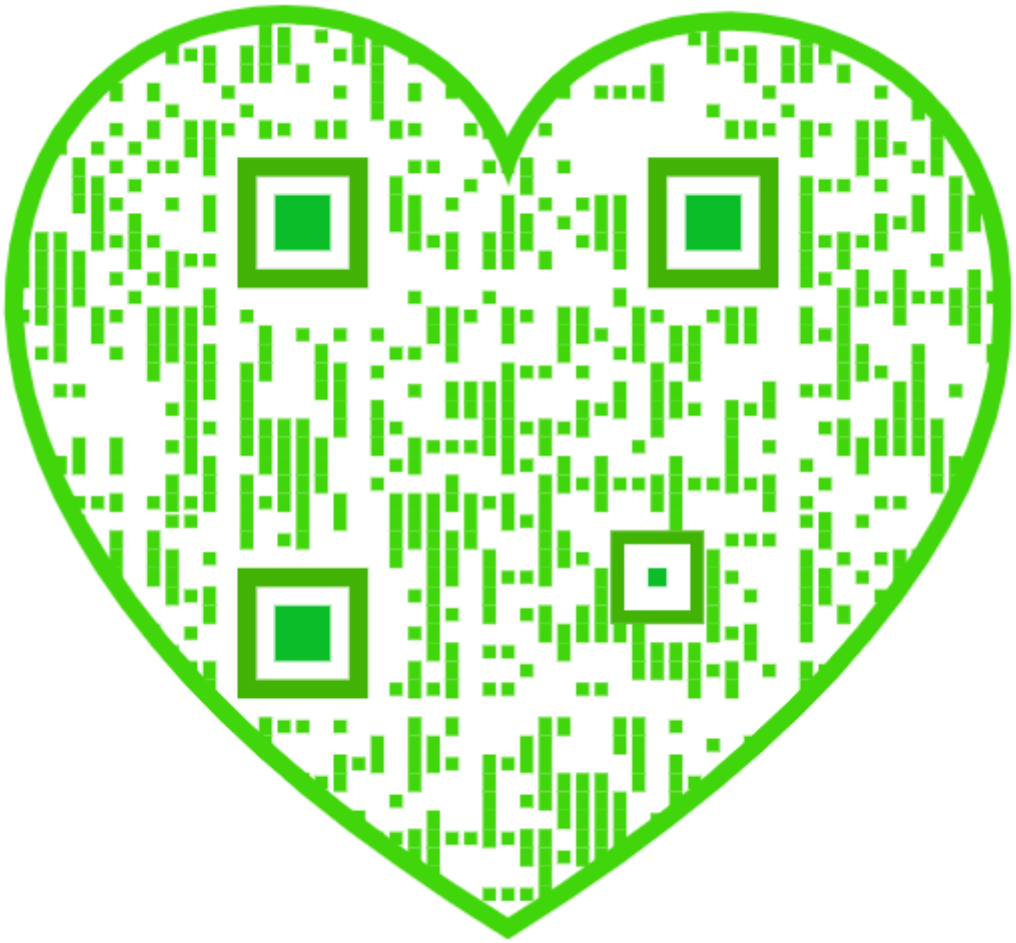
Knots for Mountaineering, Camping, Climbing, Utility, Rescue, Etc.

by: Phil D. Smith

Published by:
Phil D. Smith

This publication out of print in 1983.

Reproduction of this microfiche document in any form is subject to the same restrictions as those of the original document.

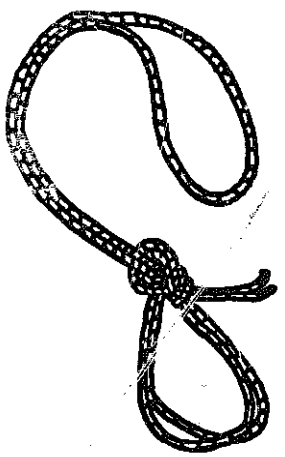


KNOTS

For

MOUNTAINEERING

Camping, Climbing, Utility, Rescue, Etc.



By

PHIL D. SMITH

Copyright 1975

By

PHIL D. SMITH

Drawings

By

RODNEY H. SMITH

Printed in U.S.A.

By

CITROGRAPH PRINTING COMPANY

Redlands, California

Third Edition

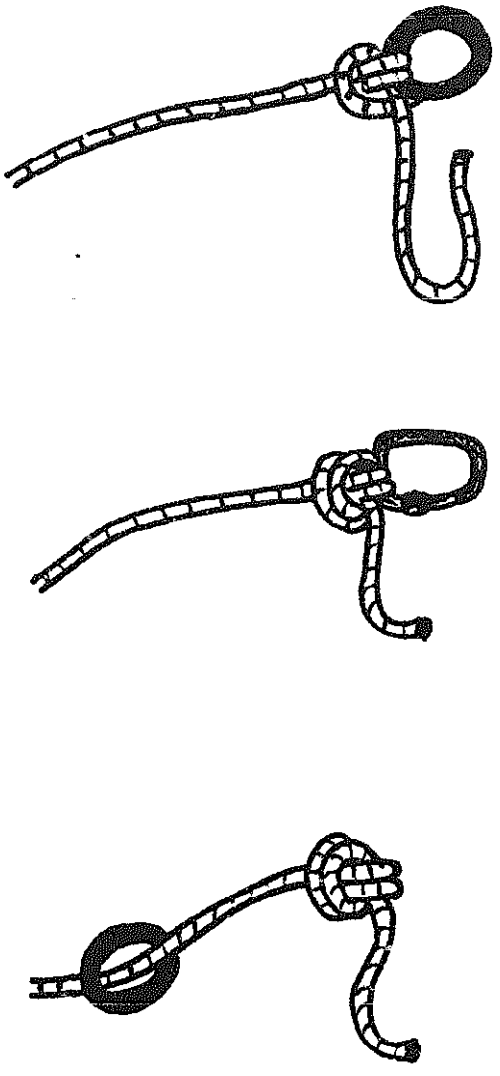
BACK COVER

The ANCHOR HITCH is one of the STRONGEST ties that one can fasten to mountain hardware, for the tying end not only adds to the dimension of the bearing but also cushions it. The DOUBLED hitch, tied by taking a second exactly parallel turn with a longer end, is an IMPROVEMENT and a good absorbant for a shock load such as a fall on the safety line. See description and Fig. 37.

With or without a carabiner, the DOUBLED tie can also serve as a "STOPPER" in the end of a line that might escape—for instance, a lowering line, an ascending line, a rappel line, etc. It is even more efficient if a ring or washer is placed ahead of it.

FRONT COVER

ADJUSTABLE BOWLINE STIRRUP: This is the Standard Bowline tied with two ends leaving a bighted end for suitable hitch attachments such as the Prusik, Ring, Catspaw, etc. Length can be varied to suit the climber's height, the loops adjusted singly or together, and when advisable, the dangling ends may be square-knotted around the ankle to hold the foot well into the stirrup. . . . To avoid over-tightening in webbing the knot can be "SLIPPED" as in Figure 51 with the dangling ends dropped through the bights and drawn up.



ANCHOR HITCHES

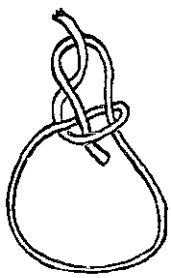
Foreword

In compiling a "digest" of knots for Mountaineering, the writer has a two-fold purpose in mind. The first is to acquaint some of the younger climbers with methods of tying that will make knots easier to remember. In order to emphasize these methods and the grouping of related knots, other illustrations showing line rigging, rope technique, etc., have been intentionally omitted.

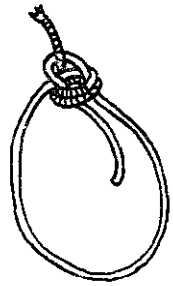
The second purpose is to bring together knots that are commonly used in mountaineering, knots that are occasionally used, and practical hitch arrangements that improve climbing safety. The names for Figures 5, 6, 20, 29 and 32 are suggestions in case they may not have been described in print.

Since mountaineering knots meet good standards they will be of service to anyone tying with rope of moderate size.

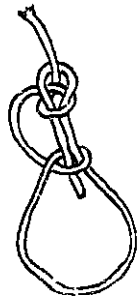
P.D.S.



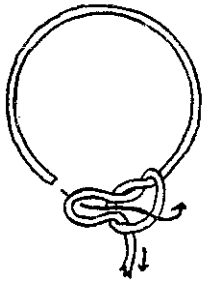
1



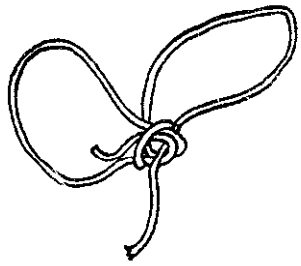
2



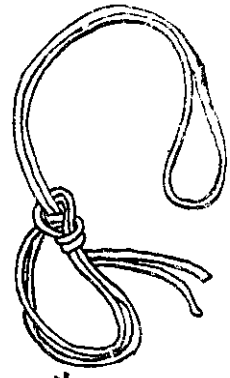
3



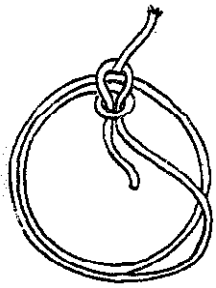
4



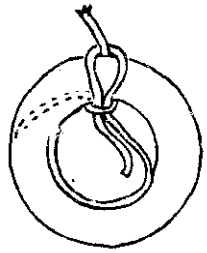
5



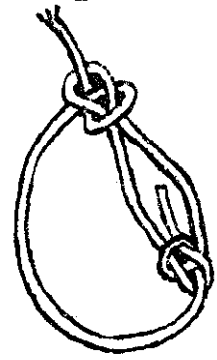
6



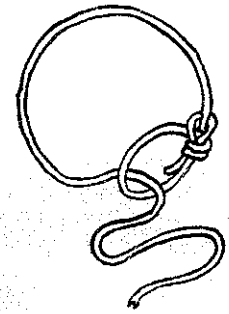
7



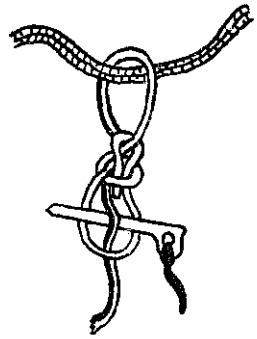
8



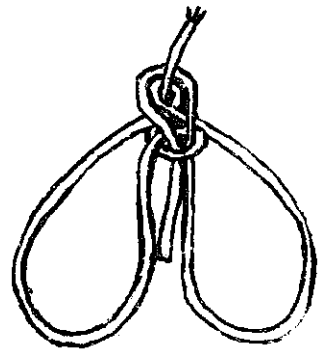
9½



10



11



9

1. Standard Bowline.

Knots used in mountaineering may be divided into several structural groups and of these, the Bowline is probably the most important and can usually be adapted to meet most rigging needs. This group deserves as much practice and study as one can give it for bowlines are so often tied under unusual circumstances that a certain amount of dexterity is required to tie each one correctly upon every occasion.

The simplest method of tying the basic knot of the group -- the Standard bowline, follows the procedure of reeving the tying end up through a Single hitch in the line, bringing it around the standing part, then down through the hitch along the inner side of the completed loop.

Another method of tying the knot begins by overhanding the end once around the line, then by cross-handing — the line being pulled back underneath, the end across and above — the hitch is formed and the end reeved around and passed through. With practice for speed this method requires about two seconds and if one possesses a flexible wrist and dexterous fingers, the knot can be tied with one hand.

2. Standard Bowline, double-knotted.

When a second turn of the same size is laid atop the hitch as one ties a Bowline, a so-called double knot results. This not only adds to the SECURITY and STABILITY of the knot but also increases its potential STRENGTH by putting a roll into the hitch and softening the lead.

3. Standard Bowline, with Single hitch.

A good utility Bowline for use on lines under stress or exposed to wet weather can be tied by using two Single hitches instead of one — the lower hitch serving to size the loop, absorb strain, and to leave the primary knot in better condition for untying.

Knots of the bowline type are easier to untie if the bighted tying end is first bent backward from the line to force slack in the hitch.

4. Standard Bowline, (cont.).

Bowline tying upon an object standing opposite or out of reach is made easier if the end is first passed or flipped around the object and then brought out through a Marlinespike hitch. This hitch (43) is formed by rolling an outside Half turn forward and drawing the line up into it only two or three inches. Hold the hitch flat, thrust the tying end through it horizontally, then after pulling the intended Bowline to desired size, push the end forward and finish the knot with an easy back pull on the line.

There are many variations of this useful tying method and again

practice will demonstrate that it can be used handily for tying overhead, that one can double-loop, double-knot, put in a Single hitch, or tie with one hand etc. It may also be adapted to tying the Sheet Bend when the lines to be joined are nearly taut or need careful control.

5. Multiple Bowlines.

Two or three loops with a single knot can also be quickly tied by the procedure just described. After making the first pass through the Marlinespike hitch with a longer end, continue it around a second (and third) object and again through the hitch before rolling it forward.

On a utility line the extra loops will center a pull upon points lying at unequal distances, may serve to hold a line away from an unfavorable position or be used for a "chair" as in Figure 9. This knot often jams tightly under heavy strain and as it is usually cleared by reversing the tying procedure, some slack should be pushed into the hitch before turning it back.

6. Bowline Sling and Stirrup.

The Standard bowline tied with parallel ends in doubled rope makes an easily adjusted sling and stirrup. Hitches may be installed before the Bowline is tied or brought through the bighted end afterwards.

NOTE: Depth and comfort can be added to the stirrup by whipping the loops separately with small rope to cause them to stand well apart. See Whipping, Figure 55.

7. French Bowline.

This bowline consists of two equalizing loops — the first passing freely across the hitch, the second knotting through it in a Standard bowline tie. It makes a good leader's knot for in case of a fall the additional loop lessens to some degree the chance of injury from the line itself.

Allowing for free passage of the first loop, the French bowline can be tied by the same several methods as the Standard. Double-knotting as in Fig. 2, may be preferred for use on safety lines.

8. Bowline on-a-Coil.

A Bowline on a coil is easily tied by overhanding the tying end on the coil and standing part. The standing part is then pulled sidewise as the end is hauled back, the two movements forming the hitch through which the end is passed after being carried on around the standing part. Too large a coil however, reduces the value of the knot and should it appear insecure or bulky the end should be half-hitched or knotted on the coil in opposition. This bowline is handy for either hanging up rope or for carrying a small surplus around the body while on the move.

9. Portuguese Bowline.

The Portuguese bowline, like the French, also has equalizing loops, which however, are splayed rather than overlying. It is formed by looping the tying end sidewise — crossing the line above the hitch — and finishing the second loop as a Standard bowline with the end, in this case, lying out between the splays.

Rescue teams will find this Bowline quite useful for a controlled descent or, when comfortably rigged, for lifting an injured person, etc. It is easily tied by following the diagram but as the procedure involves a long tying end one should first practice on a flat surface thus learning to avoid rope-twisting while making the several turns. To tie: Fix a Single hitch on the line allowing an end of 10 feet — hold the hitch firmly from behind and form the initial loop to desired size. Then cross the line but take a turn on it before forming the second loop and finish with a Bowline knot which will pull the turn down as the knot is tightened. The turn on the line prevents the loops from moving too freely and makes them adjustable.

9½. Reinforced (All Purpose) Bowline.

This reinforcement was first shown to me by Joe Hawkes, mountaineer and tree surgeon who used it consistently in a long career.

10. Running Bowline.

Although the mountaineer seldom uses a free-running noose, a small double knotted Bowline tied back around a line will serve the purpose well when a need arises. If casting, draw the line backward along a wide loop in direct opposition to the Bowline and throw out from a neat coil held in the off hand.

11. Toggled Bowline.

When the climber carries a sufficient length of emergency cord or light rope it is often possible to retrieve a single line by using a small, well-tied Bowline through which the line is backed and toggled. The toggle may be a long piton with the cord securely attached to it. This arrangement should be snuggly fitted before any weight is applied with precautions taken to see that the toggle cannot possibly strike a projection, that the line and cord are not fouled at any point, and that no injury may result from the falling toggle when it is withdrawn.

12. Bowline with-a-Bight

The Standard bowline tied with a doubled or bighted end is particularly handy for securing a line with its own slack and its close relationship to the Sheepshank (47) and Teamsters hitch (48) makes it a natural tie for holding either of these in a stable position.

When used for hauling weight the two loops should be equalized if possible and both utilized. By drawing the tying loop sidewise one may obtain Splayed loops on the bight.

13. Bowline on-the-Bight

Wherever rope is used -- in industry or in sport — one often finds this all-purpose double loop. Most mountaineers know it well and many employ it frequently as a middle-man's combination of waist and shoulder loops. Some tie it readily by first tying a loose Overhand loop (16) in a doubled section of line and then pulling the knot out through the loop with one hand while rolling the containing hitch with the other. A second and simpler method (illustrated here) begins by first turning the hitch and holding it firmly while running the bighted end out through it into a convenient balance. The two loops are then pulled out through the bighted end which draws up behind the hitch in final position. After the knot has been tightened the loops are adjusted together or each independently.

A Bowline on-the-bight should always be well tied, especially if used on the body. If poorly tied, the hitch may capsize, thus forming a dangerous double noose rather than two reliable stationary loops.

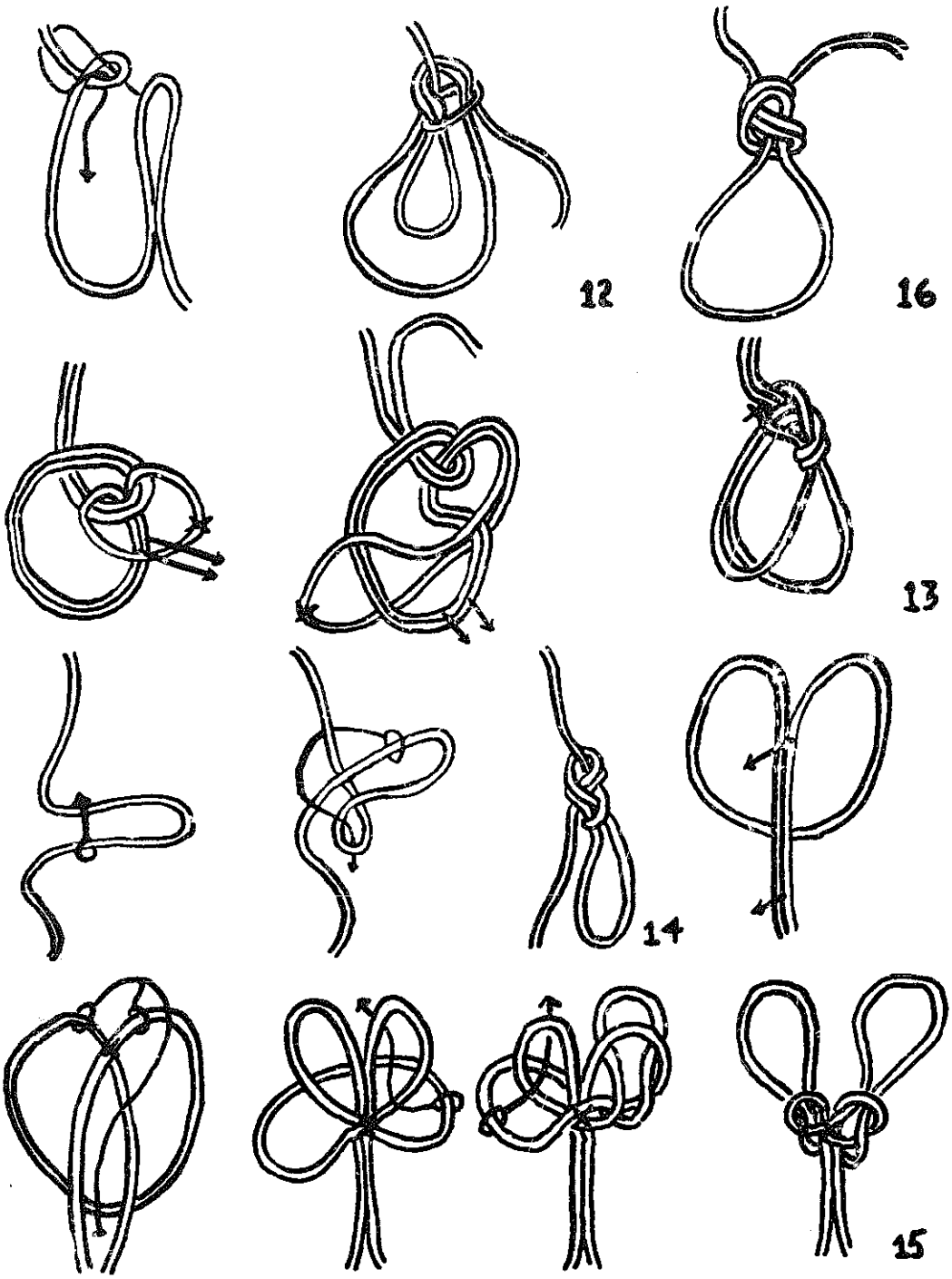
14. Single Bowline on-the-Bight.

There are several single loops that answer this description but the Figure Eight variety is the simplest, requires a minimum of rope, and is easy to untie after use. For service close along a line where only one direction pull is needed this loop may be preferred to those of a more protruding type. To tie: Draw a bight out sidewise, twist it over to form a **single** underlying hitch in the line, then pass the loop around behind the line and down through the opening.

15. Spanish Bowline.

This knot provides adjustable splayed loops in doubled line and although sometimes referred to as a "trick" Bowline, it is quite serviceable for a number of utility purposes. It may be tied with five precise movements: (1) Hold the bighted rope-end in one hand and turn it **under** with the other hand to form two equal loops; (2) hold the two loops and cross one slightly over the other; (3) turn the two crossed loops back on the **upper** side to form four loops; (4) push each outer loop down through its adjacent interior loop; (5) straighten the interior loops, hold the outer loops firmly, and tighten the knot with back-pull on the doubled line.

It will be noted that crossing the initial loops amounts to a half-turn in the line and this can be eliminated by taking a counter half-turn and running it back out of the way before beginning the knot.


12
16
13
14
15

16. Overhand Loop

The Overhand loop has a poor two-way lead and often jams tightly, but it is thoroughly secure and possesses a knot that everyone understands. On the safety line it may be used as a body loop by climbers who are not well acquainted with more practical loops such as the Butterfly, Bowline on-the-bight, etc. It makes a good loop in the extremity of a doubled line or in a larger primary loop, but is usually more difficult to untie than the Figure Eight loop (17½).

17. Harness Loop.

The Harness loop is so simple in structure that it is often referred to as a hitch, yet it is a fairly sound loop and useful for many purposes. It is tied by turning a Marlinespike hitch (43), then bighting the loop inward and pushing it back through the hitch opening.

For mountaineering the Harness loop should be regarded as a utility loop only — not as a body loop for it lacks the proper two-way lead and necessary stability for this important purpose.

17½ Figure Eight (All Purpose) Loop.

18. Butterfly or Lineman's Loop.

This excellent loop which many mountaineers use as a middleman's tie is probably the best of the single loops in the bight. It has a fine, even, two-way lead, retains its given size, and is easy to tie, untie, or adjust.

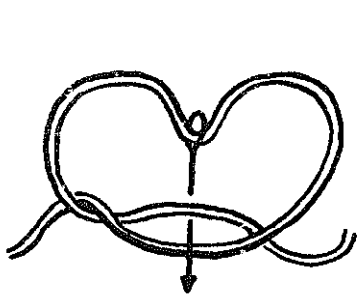
To tie: Draw a bight out sidewise from the line, give it a complete twist (two half turns) and bring the doubled end around the line and out through the crossing which was formed when the twist was taken (see drawings). Another method of tying begins by forming a fair-sized loop in the line, then laying a second loop in between the first and the line. The first loop (now outside) is then brought over the second, pulled around the line and out through **both** initial loops. Practice is required in order to approximate the size of the final single loop and to manipulate the knot correctly.

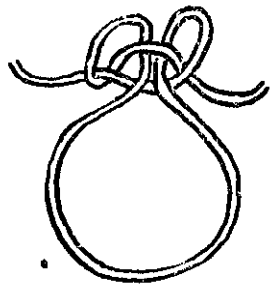
The Butterfly structure has a good nip in all kinds of material which makes its loop adaptable for a wide variety of utility purposes.

19. Twin Loops.

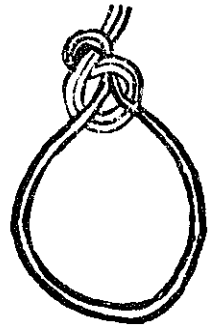
Twin loops may be tied from a Butterfly by turning the latter up **behind** the knot and drawing the "wings" out together while holding the knot firmly in hand.

This makes an excellent leg-loop arrangement in doubled rope or in larger size, a good shoulder harness for pulling a toboggan, etc.

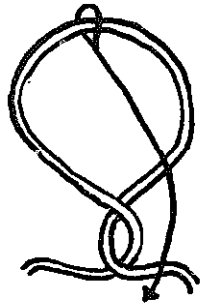


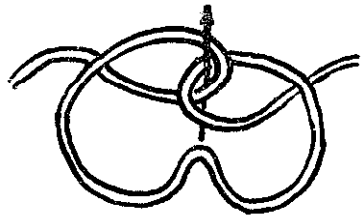


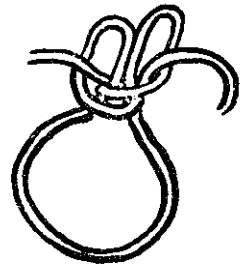
17



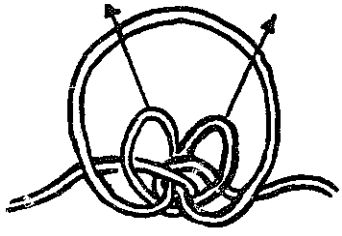
17½

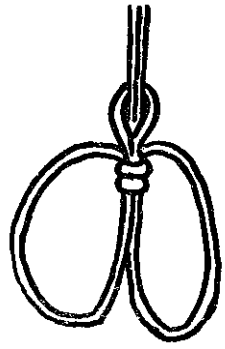




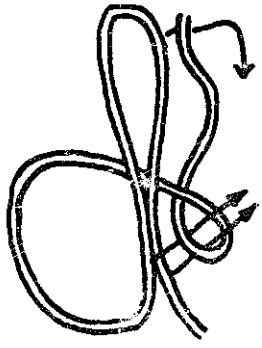


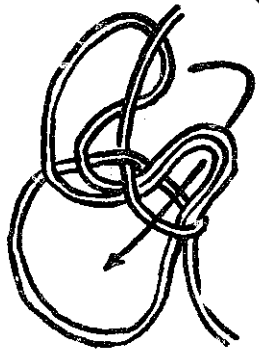
18

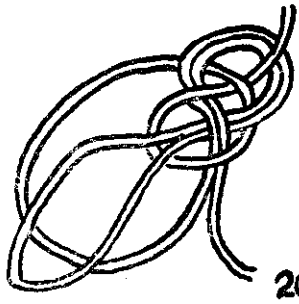




19







20

20. Cushioned Loop.

To tie a Cushioned loop in the safety line: With the line across the small of the back, turn a Single hitch close to the body; reach back at arm's length and bring a doubled section forward to lie inside the hitch thus forming a **snug** waist loop. The doubled section is then protruded sidewise through the hitch and held while its looped end is brought around under the line and pulled up between the protrusion and the hitch. The doubled end then becomes a shoulder loop and is adjusted from the chest-crossing along the line leading aft or vice versa. No adjustment of the waist loop is necessary if it is held snugly while the knot is being tied.

Several features combine to make this a good middle-man's loop but the most important lies in the abliity to tie and untie without changing body posture or releasing a strong belaying position.

21. 22. Sheet Bends.

The term "bend" usually applies to a knot or knots used to join lines or rope sections together. There are scores of such knot arrangements and although many are suitable for general mountain use only a few are at all practical for tying into safety or rappel lines. On these and other active lines the use of bends should be held to a strict minimum while the danger of allowing any to run out of reach should be recognized and pre-determined in every case.

The Sheet bend, whose knot structure is the same as the Standard bowline, is a good example of a simple primary bend although for important use double-knotting is recommended. It is tied either like a Bowline or a Becket hitch (23), and in the completed knot both short ends should lie out on the same side of the line. Should the ends appear on opposite sides it is a left-handed Sheet bend which, like the left-handed Bowline. (with the short end outside the loop), is less secure than the standard knot.

23. Double Becket Hitch.

This is a well known application of a doubled Single hitch to a closed eye or a loop and if either is flexible it is more secure than the closely related Sheet bend. Tied into a Standard bowline it may be used as a direct bend or can be utilized to attach a secondary line to a loop in the bight as shown in the diagram.

24. Opposing Sheet Bends.

Like the Bowline, the Sheet bend can be used for a great variety of utility purposes and both will serve to reinforce other knots and hitches when tying ends are available. Sheet bends tied in opposition provide a reliable method for uniting lines that vary in size or surface condition — the knots being tied so that both will hold nearly equal strain.

25. English Bend (Fishermans Knot).

For mountaineering this bend should be quite snug before it is used, with each tying end long enough to allow gripping with both hands. An added turn in each Overhand "doubles" the knot which some climbers may prefer in spite of the increased bulk.

26. Double Carrick Bend.

The True Double Carrick bend is in every respect a first-class knot and should not be confused with any of the several less reliable Single Carrick bends although the open patterns often exhibit a degree of similarity. On the accompanying diagram of the True bend it will be noted that both line leads lie under the pattern, emerge below, and are diagonally opposite, while the short ends emerge above, also diagonally opposite. When all the parts are firmly tightened the knot closes and is ready for use.

NOTE: The Double Carrick with both short ends on the same side is inferior to the True bend and is apt to distort under strain. As for the Single Carrick bends, I know of only one that is at all trustworthy and as its tying method so closely follows that of the True bend one may as well use the latter and better knot.

27. Ring Bend or Water Knot.

This is a very good bend for mountaineering, especially in new rope, and the fact that it is slightly bulky and takes a second or two longer to tie can be over-looked in favor of its excellent lead, its security and stability.

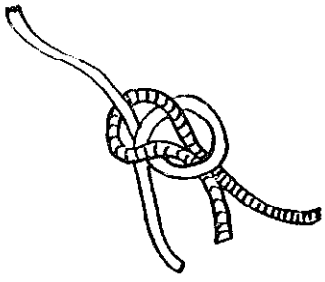
There are short cuts in tying it that can be developed with practice but the easiest method to remember begins by tying an Overhand knot in one rope end, then reeving the second rope end back into the knot in exact parallel to the first end. All parts are then drawn up neatly into compact form.

The Flemish bend, shown in Ashley's famous "Book of Knots," is tied by backing similarly into a Figure Eight knot and upon fixed lines subjected to heavy strain or wet weather, may be preferred to the Ring bend.

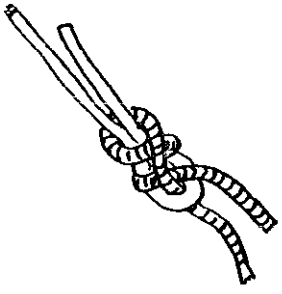
28. Butterfly Bend.

Should essential rope become damaged where its replacement is not possible, the injury may be seized with cord or tape and isolated near the tip of a small, well-tied Butterfly loop. Even if the rope should later separate at the injury the Butterfly structure is secure and stable enough to hold the rope together as a bend.

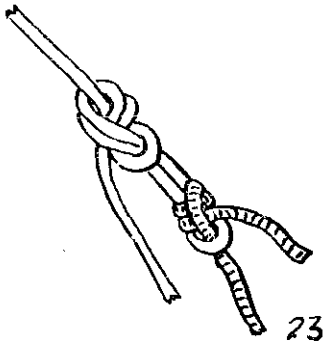
Tied as a bend between independent lines, the Butterfly is formed by crossing and reversing the two ends, turning each back around its standing part and out through the opening in the initial crossing. This



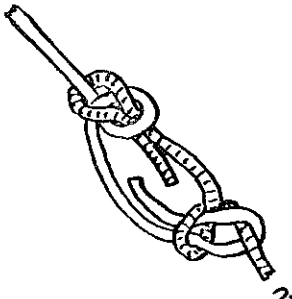
21



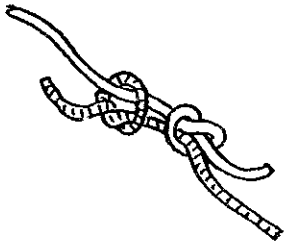
22



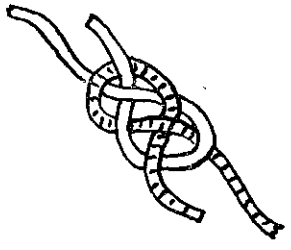
23



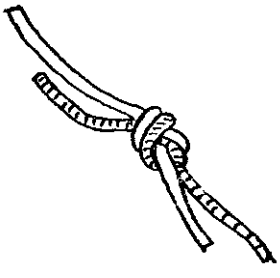
24



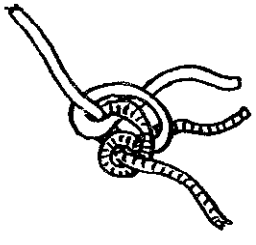
25



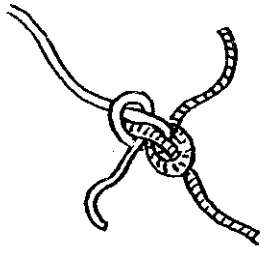
26



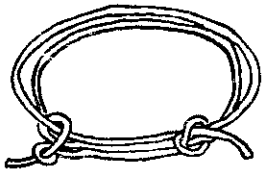
27



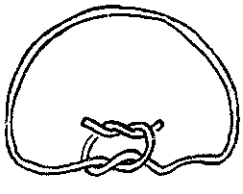
28



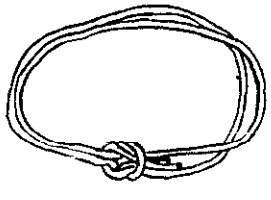
29



30



31



32

method is also used for tying the Butterfly loop but while the loop may be safely used with a soft knot, the bend should be finished with all parts firm, even, and compact.

29. Riggers Bend.

This bend is tied in somewhat the same manner as a Butterfly bend but instead of both tying ends being passed through in the same direction, one end is brought around behind the structure and through it in direct opposition to the other. The knot is then drawn up into neat, compact form with all four leads standing out at right angles.

For ordinary purposes the length of the tying ends is not important but for special rigging (which the climber may need to improvise), there is an advantage in having the ends long enough for supplementary use, such as the attachment of other lines, for holding sway in fixed rope, etc.

30. "Full" Fishermans Knot.

The Fishermans knot (25) may be adapted to contain loops or coils of reasonable size and is especially satisfactory for enclosing and equalizing several turns of sling rope. A climber using a carabiner-and-hitch attachment to the safety line (see 53) will find this knot or the Buckle knot (32), convenient for tying the ends of the doubled waist sling.

31. Square Knot.

In spite of the fact that various instruction manuals list the Square knot as a bend the mountaineer should regard it only as an A-1 binding knot. At times the security of a Square knot can be improved by Half-hitching the tying ends.

32. Buckle Knot.

The Buckle knot is a variation of the Square knot and is handy for uniting doubled rope ends or sections with a single knot. It is tied by turning back a Ring hitch (40) in a bighted end and passing the two rope ends through in opposite directions. The hitch is then rolled down over them and all parts are drawn evenly into a firm structure.

33. Single Hitch.

In addition to serving as a base for knots, other hitches, etc., the Single hitch is very useful in primary form as a binding Half turn, and in supplementary form for relieving tension, absorbing strain, equalizing pull, and so on. Simple as it is, however, this fundamental hitch is difficult to master and its correct use often requires full coordination of foresight and dexterity.

One can always pick up new ideas for tying Single hitches from teamsters, packers, riggers, sailors, and others who use them frequently to meet a great variety of every-day needs.

34. Half Hitch (Slipped).

When a Single hitch is taken on its own standing part it becomes a Half hitch, which alone is usually too insecure for ordinary use unless the end is laid away in an appropriate knot. A Half hitch in the bight, tied with the doubled end left in slipped position is sometimes handy for temporary holding and instant release.

35. Standard Half Hitches.

Half hitches used primarily to hold weight or withstand strain should be drawn tightly upon each other and into a closed position from which they cannot work or slip. Quite often an initial **Round Turn** on an object will add greatly to the efficiency of the hitches and also aid in holding while they are being installed.

36. Reversed Half Hitches.

If rope is hard, wet, or springy, a firmer purchase on an object is sometimes possible when the direction of the second Half hitch is **reversed** and tightly drawn down on the first. Reversed Half hitches are closely related to the Square knot - - in fact, one can tie the Square knot as a loop and capsize it into Reversed hitches. The Granny knot, tied as a loop, will likewise capsize into Standard Half hitches.

37. Anchor Hitch or Fishermans Bend.

Whenever it is necessary to attach a line to a carabiner, a ring, or an object that provides a good bearing, this combination of the Half hitch and Round turn is strong and reliable. With some slack in the line, first take a Round turn on the bearing, then a Half hitch with the tying end being brought through **under** the turn. At this point one may either double the hitch with a second parellel pass or lay the end up in another Half hitch.

NOTE: The knot equivalent of the Anchor hitch is an Overhand knot with two loops instead of one. The hitch appears when the end is brought up alongside the standing part.

38. Timber Hitch.

Anyone who camps out should become familiar with this hitch for it will serve a variety of work needs. It is tied as a Half hitch with a long end which is then laid away in over and under sequence along the lay of the strands in the loop.

A cross or ninety degree pull usually binds the hitch firmly, but in a narrow longitudinal pull on an object, an advanced Single hitch (33) should be used to prevent the Timber hitch from distorting or slipping forward.

39. Clove Hitch.

The Clove hitch consists of two Single hitches so turned that each serves to bind the other when tightened upon an object. It is the best known of the compound hitches and is quite reliable and efficient when properly applied. It has a tendency to shift position however, when the direction of pull is changed or relaxed, so should be stabilized with Half hitches or a knot when tied near an end.

Clove hitches of moderate size are easy to turn if one holds the line with one hand palm down, the other palm up, then rolls both over in the same direction. The Single hitches are then brought together, one behind the other. Rolling the hitches with one arm crossing the other, while one leans sidewise, is a quick method of tying a Clove hitch in extra large size.

40. Reversed Single Hitches or Ring Hitch.

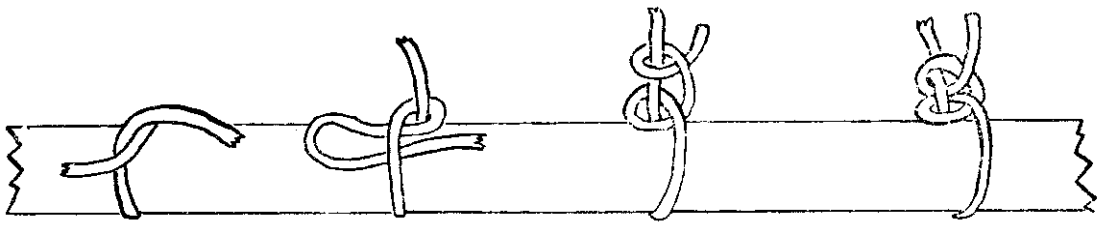
This hitch has a great variety of uses and often is a good substitute for the Clove hitch when the latter is impractical. In the bight it is quickly tied by holding line in both hands, then turning both either inward or outward and bringing the two loops together.

When tied near an end, either in the bight or by reeving, it is better to stabilize the hitch by laying up the end in a Bowline. A doubled Ring hitch appears in Figure 45 as the Prusik hitch.

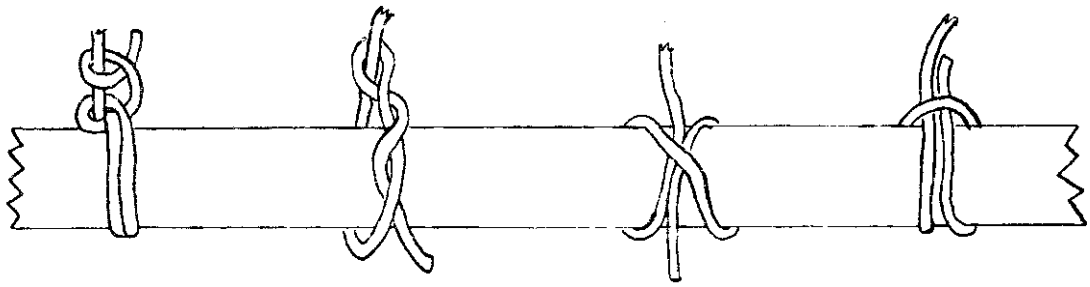
41. Constrictor Hitch.

The Constrictor is only a step beyond the Clove hitch as is demonstrated by tying a Clove hitch on an upright with short rope, then tucking either end over and out under the loop opposite. Both ends are then pulled firmly in opposition to create a complete bind. To tie in the bight; one first makes a fair sized Half turn which, if the crossing leads over to the right, is held in the right hand with fingers extended in order to hold the loop up and open. The left hand is then passed under the line palm down, turns half the loop outward and brings it back under to lie against the part still held by the right hand. With a little practice this tie is quick and sure.

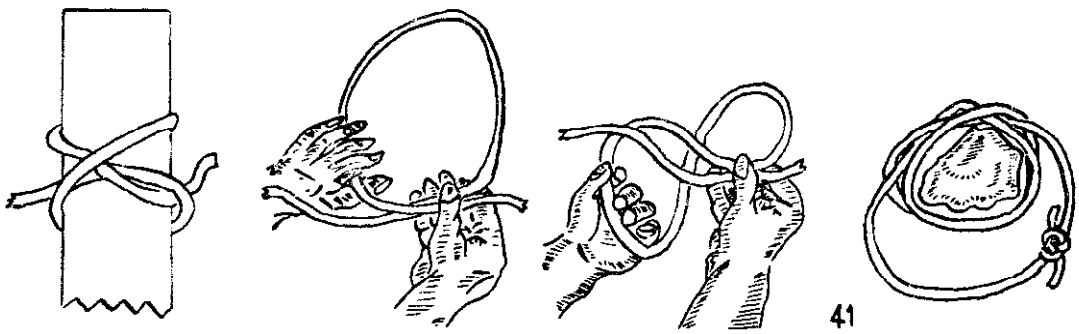
There are many uses for the Constrictor hitch around camp and at times it may prove handy on a climb itself. For instance it is recommended for: (1) "freezing" sling rope to a suitable projection; (2)



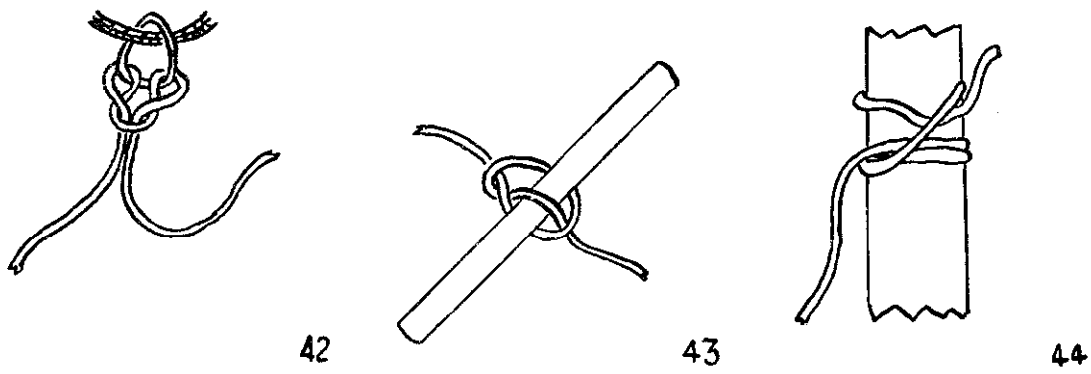
33 34 35 36



37 38 39 40



41



42 43 44

bending cord to rope, the cord end then being laid up in Half hitches; (3) stopping rope ends or prospective ends with small cord before rope is cut, the cord ends being tied firmly behind with Square knots; (4) temporary stoppings on coiled rope when binders or straps are not at hand; (5) hoisting certain equipment such as ice axes, poles, etc., where a tight binding hitch is more desirable then the ordinary standard hitch.

42. Catspaw Hitch.

A Catspaw may be reeved near an end but is usually tied in the bight by continuing to turn two loops inward until they lie closely and evenly together. It is an efficient hitch, easy on material, and recommended for use in rigging combinations of rope and hardware.

43. Marlinespike Hitch.

This hitch has previously been introduced in connection with the tying of Bowlines and the Harness loop but as it also has value in basic form and is easy to manipulate with one hand, the climber may often prefer it to other better-known hitches. A mere turn of the hand and a pick up of the line fashions the hitch which will readily adjust to fit on an object or serve as a stationary "post" hitch. On the line itself it is handy for taking in and holding slack, for shortening line, and to promote discussion and experiment may find further uses in belaying from a carabiner or an ice axe.

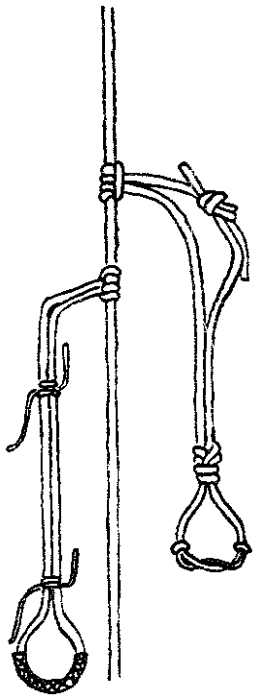
A good practice method for turning Marlinespike hitches begins by holding a line with hands wide apart, then rolling both outward and inward for varying aspects of the hitch in the pick up. Pulling the line through produces a simple Overhand noose — a poor running noose compared to (10) — but a good binding loop or a frictional hitch depending on which direction it is allowed to move. (See also, 53).

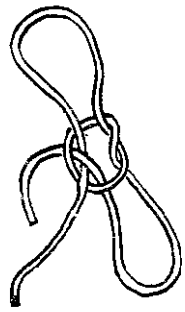
44. Magnus or Rolling Hitch.

The Magnus is an excellent work hitch for pulling, lifting, or rolling an object that may otherwise be difficult to grip. For ordinary purposes only two turns with a Single hitch above are sufficient but when the object is narrow or slippery (such as other rope) three turns with two locking hitches often improve both grip and security.

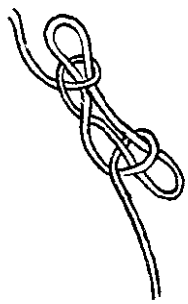
45. Prusik Hitch.

This hitch, sometimes called a knot, combines the gripping principle of the Rolling hitch with that of the Ring hitch, and thus affords the climber a simple and efficient method of climbing a fixed line or parallel lines with stirrups of small-diameter rope. In these one can stand erect and slide the hitches upward or downward in succession while taking steps toward an objective. Quarter inch manila applied

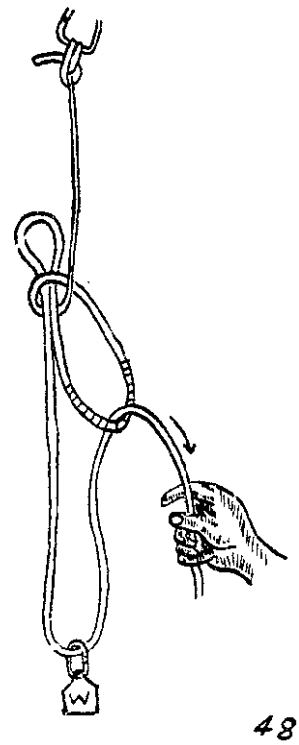




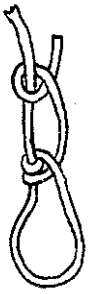
46



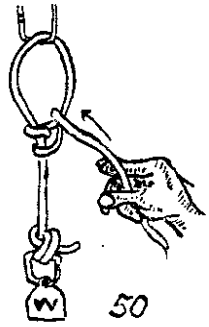
47



48



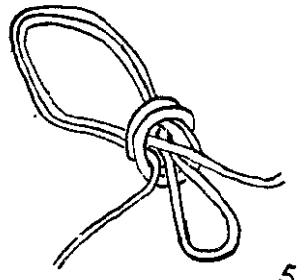
49



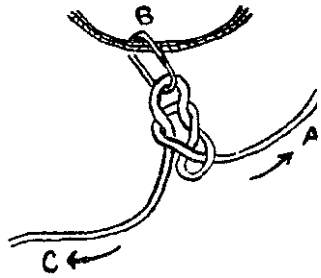
50

45

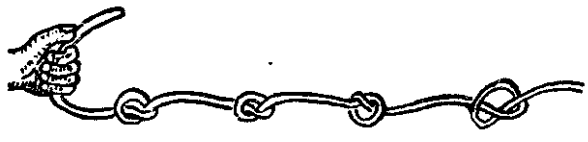
51



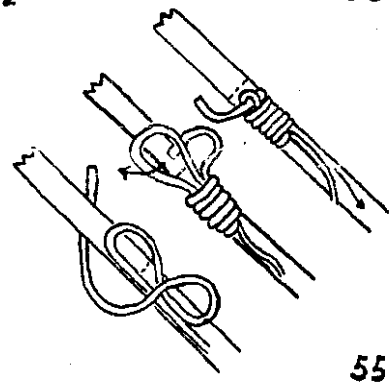
52



53



54



55

to standard 7/16" or doubled 5/16" line is a satisfactory ratio and when fully rigged the length of the slings should approximate the distance from the shoe sole to the lower chest, depending on the climber's height. These measurements are suggested by Fred Beckey who also lists the following uses he has found for Prusik hitches while climbing on difficult terrain:

(1) For climbing on flawless areas over which it is possible to anchor a line; (2) for direct ascent by the second or third man on an independent line (this may save time on Class 6 pitches and allow either man to safely remove or arrange special rigging); (3) for **self-escape** from a crevasse or overhang after a fall; (4) for stopping on a rappel to perform work or to assist with a rescue, etc.; (5) for use as "straps" or "stays" on lines rigged for rescue or upon lines that require careful handling.

A variety of slings and stirrups may be used with Prusik hitches. Two are shown in the accompanying figure — one Short-spliced and seized with Constrictor hitches (41); the other, knotted with a Ring bend (27), a Figure Eight loop, and a flat Sheepshank (47). The Bowline sling and stirrup (6) however, is adjustable through its single knot and is easier to tie in the field.

NOTE: Prusik climbing on parallel taut lines with a stirrup mounted on each and tightened through a base anchor, is much easier than climbing on a single line. Also, tension may be alternated in the lines by an assistant, which helps the climber to move the hitches over bulges, projections, etc.

46. Extension Hitch.

This is the rigger's adaptation of the trick Handcuff knot — for equalizing pull, changing the direction of pull from two or more points, or for shortening rope at a doubled end. It is tied either by reeving with an end or by drawing the two turns of a Clove hitch out through each other. The bighted ends may be extended into secondary knots and hitches as desired.

47. Sheepshank.

Sheepshanks are seldom used in mountaineering but every climber should know at least one in case he might need to arrange tackle for a rescue or some other emergency where special rigging is required. The Sheepshank shown here is easily tied by turning three Single hitches in the same direction and elongating the middle one through the outer two which are then drawn tight on the protruding bights. On a Long Sheepshank, the outlying hitches can be turned by overhanding the bighted ends on the line or the bighted ends may be passed through hitches turned with the off hand. To prevent a spill, a bighted end not in use can be tied in like a Bowline with-a-bight (12), toggled in place, or held by a seizing or Half hitch.

A Sheepshank on-a-coil is an efficient method for reducing a long line to a moderate distance, for laying away excess slack, and for hanging up a coil to protect it from damage. Sheepshanks tied in short lengths of rope, with the ends passed through the bights, make good cradles or binding cradles, if the ends are brought through opposite bights.

48. Teamsters Hitch.

The Teamsters hitch is ordinarily used to tighten load lashings but in an extremity it can be rigged to assist with heavy pulling on long lines — to serve in this case as a fair substitute for block and tackle. Pull is made from a strong anchor point through a carabiner on the load and brought back through the hitch to a convenient work station. The coil can be used as a tying end if so desired but one can tie in the bight by carrying slack on the arm, spilling it against the line while the hitch is brought up from underneath with the hand and slipped or overhanded into the basic Single hitch. The unused bighted end may be held to the line by a second Single hitch or otherwise secured in position should it seem necessary. Pull can be increased by introducing second and third hitches back on the pulling line but this procedure requires good judgment in order to avoid over-stretching the line if a stall occurs.

49. Midshipmans Hitch.

The Midshipmans hitch is an adjustable loop with the same knot structure as the Magnus or Rolling hitch (44). It is tied by taking two (or three) turns on the standing line inside the loop and finishing with a tight Half hitch or two above. The rolling action of the hitch serves to grip the standing part when the pull is on the loop, yet it can be easily moved to any given point by only slight hand pressure. Whether the mountaineer is traveling, camping, or climbing he may at times find this hitch useful for shortening or slackening rope without untying or retying a knot arrangement.

Two turns upon the standing part with the Half hitch beneath and within the loop are sometimes handier for securing at a low point.

50. Controlling Hitch.

Although seldom described in print this hitch is well known to sailors and water-front workers as a means for lowering heavy weight or to stall moving line. It is shown here (in simple form) as a weighted line running through an anchored carabiner with two turns on the standing part and stalled by the coiled end passed through the loop and hauled back. When used in lowering, in either simple or complex form, there are particular line features to pre-determine, i.e. (1) that the distance the hitch can move exceeds the lowering distance; (2) that the line to be paid out is sufficiently long — the lowering distance being the minimum.

For controlling a line used for belaying, the hitch can be adapted to the bight, the extra slack being ignored in this case. It is quick and handy for holding a climber resting, the stall being pushed outward when the belayer's body serves as the anchor.

51. Slipped Noose.

Use of this knot is one of the quickest and simplest methods of fastening a line to an object, for all that is required is a turn around the standing part with a tuck of the bighted end under and back through the turn. After use the knot is instantly spilled by pulling out the bight with the hand or, when safely rigged, **from a distance** with an independent and well attached light line.

52. Doubled Noose.

When the safety line needs to be tied into a carabiner or sling as an expedient or in an emergency a Doubled Noose in-the-bight will serve the purpose for it will hold strain in either or in both directions simultaneously. This knot can easily be tied by running a bighted section into the loop as a Becket hitch (23) and then pulling the structure down upon the slack line. After tying, the doubled end may be seized with a Single hitch in the line leading down or laid away by tipping it up into the carabiner.

53. Figure Eight Noose.

The Figure Eight noose is tied in the bight by taking a **full** turn of slack and pulling the line through as a loop which can be used either in **advancing** form as a binder, or **in retreat** as a frictional or delaying hitch. The accompanying diagram shows how the latter (favoring a leader, A) is attached to the waist sling of a middle-man, B, when a group is moving together on snow and ice. Thus, any falls by either A or B may be delayed with the line slack between B and C or in exceptional situations the hitch can be tied to favor C on available AB slack. For climbing on rock and mixed terrain where belaying from a station is necessary, B can change to a Catspaw hitch (42) to stabilize his line position.

NOTE: Should A and C prefer to climb in waist slings or safety belts instead of the traditional line loops, the strong Anchor hitch (37) can be used on a carabiner attachment.

54. Overhand Series.

Fixed rope used for direct aid or to assist a laden party over difficult terrain will afford better protection if a few well-spaced knots are installed when the line is placed. This can be done by laying up Single hitches in the hand or along the arm while working toward an end. The end is then grasped and hauled back causing successive Overhand knots to appear at intervals relative to the size of the hitches. Untying is performed by opening up the knots and reversing the end through several knots at a time.

On a long line it is better to work from the middle toward each end in turn. If any loops are needed one can allow slack or free turns at intervals while laying up the hitches.

55. Simple Whipping.

The whipping shown here has no protruding parts when finished, will bind down tightly enough to approximate the diameter of the rope, and is not difficult to draw up when strong material such as fishline, is used. There is an advantage in whipping a rope-end before it is severed but if this is not possible a tight seizing can be used to hold the strands firmly together until the operation is completed. Whipping should lie back from the end at about the same distance as half the diameter of the rope and in length should cover a little more than the diameter.

A number of years ago, Bert Jensen showed me how to "freeze" whipping along with the rope-end, by working in liquid solder and allowing it to dry slowly. I have since used this protection not only on alpine rope but also on lashing rope in every-day use and have found it quite satisfactory. The metallic tips are easy to manipulate and in most cases will outwear the rope itself.

56. Snarls.

SNARLS and KNOTS that have lost identity may be removed from a line by securing the longer segment to a projection or having someone hold it firmly while the complexity is being cleared. After loosening the snarl as much as possible, open the uppermost bight and work it downward so that the entire mass (with the end) will pass through it. Each upper bight is then opened in turn and the procedure repeated until the line is completely cleared. Any twists are then taken out by pulling the line through the closed hand.

57.

DECORATIVE KNOTS would seem to have little use in mountaineering but a TURKS HEAD tied under the head of an ice axe with soft cord makes a comfortable, insulating grip. Methods for tying a simple Turks Head from either a Clove hitch or a Figure Eight base are usually described in seaman's manuals in company with the following knots and splices:

MULTISTRAND KNOTS, such as the CROWN, the WALL, and their combinations will be found useful while repairing and replacing utility rope about camp.

SPLICES are also useful and quite easy to learn if one begins with rope of firm lay. SHORT and LONG SPLICES, the BACK-SPLICE, and a good EYE SPLICE will meet general utility needs but of course do not often appear on any running lines due to the danger of fouling.

The STANDARD BOWLINE is a good knot in light cable and two (or more) bowlines tied through each other can be used as a bend or, with an intermediate Square knot, for bending rope to cable.

Current References

KNOTS, HITCHES, SPLICES, ETC.

Bluejackets Manual. U.S. Naval Institute, Annapolis, Md.

Book of Knots. Clifford W. Ashley. Doubleday & Co., Garden City, New York.

Compton's Pictorial Encyclopedia. The Encyclopedia Americana and the Encyclopedia Britannica.

Knots and How to Tie Them. Boy Scouts of America, New York, N.Y.

Knots and Splices. Percy Blandford. Arco Publishing Co., New York, N.Y.

Merriam-Webster Dictionaries. G & C Merriam Co., Springfield, Mass.

Rigging. Dept. of the Army, Washington, D.C.

Ropes, Knots and Slings for Climbers. Walt Wi lock. Revision by Royal Robbins. La Siesta Press, Glendale, Calif.

(Several leading cordage manufacturers also publish information about knots, the proper care of rope, etc.)

CLIMBING TECHNIQUE

Basic Mountaineering. Sierra Club, San Diego, Calif.

Basic Rockcraft, also Advanced Rockcraft, both by Royal Robbins. La Siesta Press, Glendale, Calif.

Beginners Guide to Rock and Mountain Climbing, Ruth & John Mendenhall. Stackpole Books, Harrisburg, Pa.

Belaying the Leader Omnibus. Sierra Club, San Francisco, Calif.

Fundamentals of Rock Climbing. M.I.T. Outing Club, Cambridge, Mass.

Handbook of American Mountaineering. K. A. Henderson. Houghton Mifflin Co., Boston, Mass.

Introduction to Caving. John Thraikill. Gerry Mountaineering Equipment Co., Ward, Colo.

Manual of Ski Mountaineering. D. R. Brower. Univ. of California Press, Berkeley, Calif.

Mountaineering. Alan Blackshaw. Penguin Books, Baltimore, Md.

Mountaineering—Freedom of the Hills. Mountaineers Club, Seattle, Wash.

Mountain Operations. War Dept. Govt. Printing Office, Washington. D.C.

Mountain Search and Rescue Operations. Grand Teton National Park, Wyo.

Mountain Search and Rescue Techniques. W. G. May. Rocky Mountain Rescue Group, Boulder, Colo.

On Snow and Rock. Gaston Rebuffat. N.Y. Oxford University Press, New York, N.Y.

Wilderness Handbook. Paul Petzoldt. W. W. Norton & Co., New York, N.Y.

Glossary

BELAY, to. To protect or to control with a safety line. Related terms: a belay, belay point, belaying stance, etc.

BEND, a. See paragraph 21a.

BIGHT, a. A nearly-closed curve in a piece of rope. A doubled segment.

BIGHT, In or On—the. A turn or a knot figure taken between the ends. Tying, without using the ends.

BIGHTED END. A doubled end used for tying.

CAPSIZE. To fall out. To lose identity.

CARABINER. A metal snap-link.

CLASS 6 Pitch. Mountain terrain is often classified in grades of from 1 to 6 in difficulty. 6 may require the placement of artificial aids for successful climbing.

"CRADLE". A supporting rope carrier.

EFFICIENCY of Knot or a Hitch used in the field is the resultant of security, strength, stability, and proper use.

EYE. A small fixed loop.

EYE SPLICE. A loop resulting from an end being spliced back into its standing part.

HALF TURN or TWIST. A turn best demonstrated by holding rope with the hand palm out, then turning the hand palm in. A repeated movement results in a Full turn or twist.

HITCH. The term often applied to a temporary rope fastening. Hitches may be either active or stationary.

LEAD. The direction taken by the line or an end after making a turn.

LINE. Rope in use or prepared for use.

LOOP. A rope segment closing upon itself.

NIP. The binding and frictional pressure within a knot which prevents its slipping.

NOOSE. A sliding loop.

OVERHAND, to. To turn the end over and under like tying an Overhand knot.

PITON. A spike which can be driven into a crack or a hole to serve as an anchor point.

RAPPEL. A self-controlled descent upon an anchored line. Also the act of riding down on a line.

REEVING. Tying a knot or hitch with an end.

ROUND TURN. A complete turn taken upon an object and brought back.

SECURE, to. To tie down. To fasten firmly.

SECURITY of a KNOT. The property which causes it to hold together when under stress or shock. Also, its resistance to spilling under repeated shock.

SEIZE, to. To hold together with supplemental rope or cord.

SEIZINGS. Small stuff used to grip sections of rope.

SLING. A supplemental loop attachment.

"SLIPPED". The tucked position of an end which allows it to be instantly withdrawn. (See Figures 34, 51).

STABILITY of a KNOT. The property which causes it to hold together when stress or loading is absent or has been released.

STANDING PART. The primary section of a line. The stem.

STAY. A rope fixture on a line used to prevent slipping or overstrain.

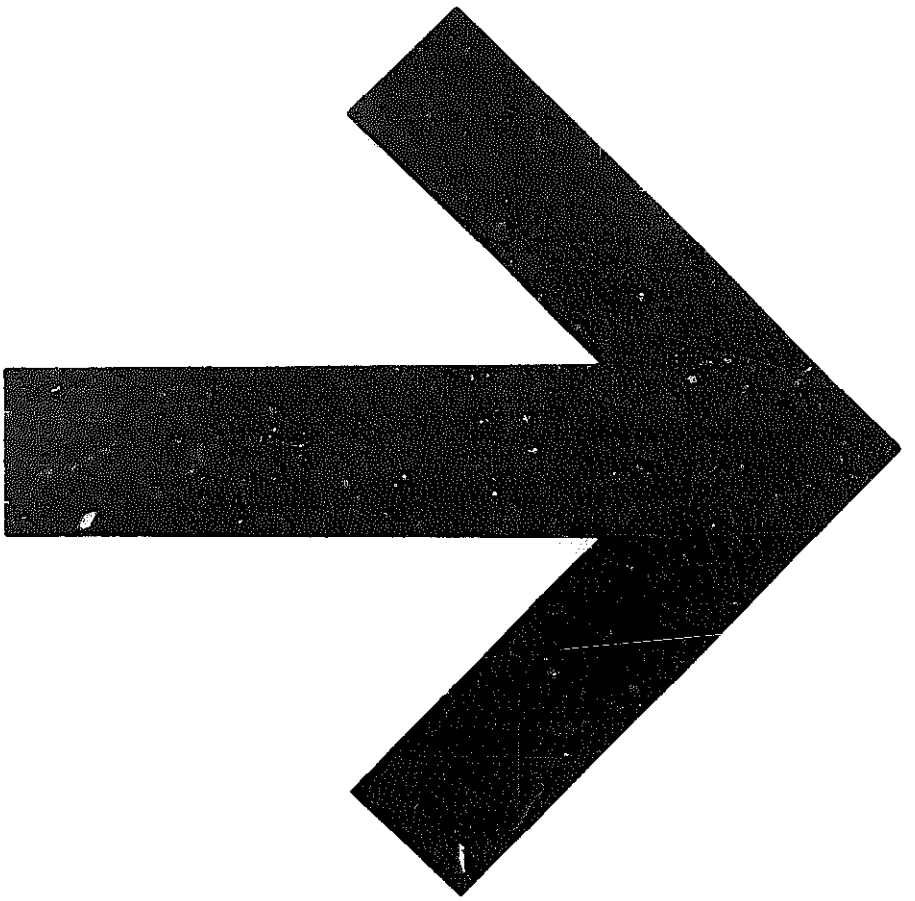
STOPPINGS. Small stuff used to prevent rope from opening up or fraying out.

STOPPER. A knot or a fixture used to prevent rope from passing through an aperture.

STRAP (on a line). A sling attachment serving as a grip.

STRENGTH of a KNOT. Its resistance to breakage from strain or shock.

TOGGLE. A pin inserted in a rope arrangement to prevent it from spilling.



Index

Anchor hitch — 37, 53b

Becket hitch — 23
Bends, in rope — 22-29; cord to rope, 41; rope to cable, 57d
Bowlines — Tied with an end 1-11; in the bight 12-15
Bowline on-the-Bight — 13, single 14
Bowline on-a-Coil — 8
Bowline Sling and Stirrup — 6
Bowline with-a-Bight — 12
Buckle knot — 32
Butterfly bend — 28
Butterfly loop — 18

Carrick bends — 26
Catspaw hitch — 42, 53a
Clove hitch — 39
Constrictor Hitch — 41, 45c
Controlling hitch — 50
Cradles, Sheepshank — 47b
Crown knot — 57b
Cushioned loop — 20

Doubled Noose — 52

English bend — 25
Extension hitch — 46

Figure Eight Knot — 27c
Figure Eight Loop — 17½, 45c
Figure Eight noose — 53
Fishermans bend — 37
Fishermans knot — 25, 30
Flemesh Bend — 27c
French bowline — 7
Frictional hitches — 53, 43b

Girth Hitch—(See Ring Hitch, 40)
Granny knot — 36

Half hitches — 34, 35, reversed, 36
Handcuff knot — 46
Harness loop — 17
Hitches — 33-50; frictional 43b, 53

Knots especially for new or slippery rope — 2, 17½, 18, 20, 27, 37

Linemans loop — 18

Magnus hitch — 44, 49
Marlinespike hitch — 4, 43
Midshipmans hitch — 49
Multiple bowlines — 5
Multistrand knots — 57b
Nooses — 10, 43b, 51, 52, 53

Overhand knots — 25, 30, 54, doubled 25, 37
Overhand loop — 16
Overhand noose — 43b, 51, 52
Overhand series — 54

Portuguese bowline — 9
Prusik hitch — 45
Prusik ladder — 45d
Prusik stirrups — 45c, 6

Reef knot (see Square knot, 31)
Reversed Half hitches — 36
Reversed Single hitches — 40
Riggers bend — 29
Ring bend — 27
Ring Hitch — 40, doubled (see Prusik hitch 45)
Rolling hitch — 44, 45a, 49
Round Turn — 35, 37
Running bowline — 10

Sheepshank — 47
Sheepshank on-a-Coil — 47b
Sheet bends — 21, 22, 24
Short Splice — 45c, 57c
Single bowline on-the-Bight — 14
Single hitches — 3, 33, 39, 40, 54 doubled — 23, 45
Slipped Half hitch — 34
Slipped noose — 51
Snarls — 56
Spanish bowline — 15
Splices — 57c
Square knot — 31, 32, 36
Standard bowline — 1, 4
  double knotted — 2
  with single hitch — 3
  in cable — 57d
Standard Half hitches — 35

Tautline hitch (see Midshipmans hitch. 49)
Teamsters hitch — 48
Timber hitch — 38
Toggled bowline — 11
Turks Heads — 57a
Twin loops (from a Butterfly) — 19

Wall knot — 57b
Waterknot — 27
Whipping — 55